

BAY-210

Title of the Invention

WATERPROOF/BREATHABLE MOISTURE TRANSFER LINER FOR IN-LINE
SKATES AND THE LIKE

Inventor

Baychar

08887847 "070397"

**WATERPROOF/BREATHABLE MOISTURE TRANSFER LINER FOR IN-LINE
SKATES AND THE LIKE**

FIELD OF THE INVENTION

The present invention relates to liners used in a variety of application. For example, the liner of the present invention may be employed in a variety of applications including in-line skates (shell and soft boot) and the like. The liner is breathable and waterproof to increase comfort for the skater.

BACKGROUND OF THE INVENTION

Various types of liners are known in the prior art. These liners are designed to provide certain levels of comfort and durability. Furthermore, in-line skates are also well known in the art as evidenced by U.S. Patent Nos. 5,340,132, 5,397,141 and 5,437,466. Of these patents, only U.S. Patent No. 5,437,466 discloses what is commonly referred to as a "soft-boot". In other words, the shoe body is made of a soft, pliable material. General statements are provided about the materials used for the shoe body, but not in great detail.

However, the liners and in-line skates, as well as snowboard boots, etc., known in the art do not provide the advantages realized by the present invention. With the art of in-line skating becoming increasing recreational, numerous categories of skaters are developing in large numbers. The present inventor has recognized the problems faced by the

aggressive and the recreational categories of skaters and has developed a liner to overcome such problems.

There is an ongoing need for comfort, breathability and support for both removable liners as well as soft boot liners. In prior removable liner designs, the conventional liner is often constructed with rigid, non-breathable outer materials, such as vinyl's, foams and nylons. The inner liners have been leather, nylon or polyester blends which extremely limited the ability to breathe or wick moisture away from a skater's body. These materials have prevented the foot from breathing adequately. In the case of "shell boot" skates, the plastic material that forms the outer shell boot structure holds the heat and moisture inside the boot. As a result, the lining becomes saturated with sweat which adversely affects the skater's comfort and performance level. This problem is even worse with the aggressive skaters whose needs for proper ventilation are even greater.

SUMMARY OF THE INVENTION

An object of the present invention is to provide lining system employing a cooler and more breathable liner that meets the needs of each individual skater. Accordingly, the liner of the present invention can be accommodated to the needs of skaters of various skill categories by permitting the inner liner material, which is against the foot, to vary in fiber content and construction.

This object of the present invention is realized by providing a lining system having lining materials which act as a moisture transfer system. Moisture vapors are transferred through the liner from one side to the other side. This is accomplished by utilizing certain materials in a manner determined by the inventor after considerable experimentation and effort. The details of the specific materials as used in the combination are disclosed in the Detailed Description of the Preferred Embodiments.

The moisture transferring lining system of the present invention overcomes the problems in the prior art lining systems and liners and meets the needs of even the most aggressive skaters.

Various other objects, features and advantages of the present invention will become readily apparent in view of the following detailed description of the preferred embodiments in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 illustrates a first portion of the liner according to a first embodiment of the present invention.

Figure 2 illustrates a second portion of the liner according to a first embodiment of the present invention.

Figure 3 illustrates an example of the liner according to the first embodiment of the present invention.

Figure 4 illustrates the liner shown in Figure 3 as applied to an inline skate.

Figures 5(a) and 5(b) illustrate a sole portion of a shoe constructed according to a preferred embodiment of the present invention.

Figures 6 and 7 illustrate a tongue portion of a shoe constructed according to a first embodiment of the present invention.

Figure 8 illustrates a more detailed view of the liner portion used for the tongue of Figures 6 and 7.

Figure 9 illustrates a portion of the liner used in the upper cuff area.

Figure 10 illustrates the travel of moisture through a reticulated foam then a flexible mesh and into and through a breathable membrane according to the first embodiment of the present invention.

Figure 11 illustrates the toe portion of a shoe according to a preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The following detailed description of the preferred embodiments of the present invention is undertaken in connection with the drawings. This description, while undertaken with respect to the disclosed embodiments, is intended to enable a variety of different applications and slight modifications which form a part of the present invention. More specifically, many of the materials used in this lining system have been developed relatively recently, and in many cases are still being modified and improved.

Where possible, tradenames of specific products have been used to assist in the understanding of the invention. The lining system according to the present invention can be easily adapted to accommodate further developments in these materials. With this in mind, the preferred embodiments currently envisioned are set forth below.

Figure 1 illustrates a portion of the liner, or lining system, according to a first embodiment of the present invention. As shown in Figure 1, a first foam material 20 is provided between an inner liner 10 and a second foam material 30. The inner liner 10 can be attached to the first foam material 20 by lamination, stitch or ultra sonically bonded or the like. The second foam material 30 is a germicidal antimicrobial reticulated and/or hydrophilic open cell foam and has a thickness of approximately $\frac{1}{4}$ inch. The first foam material is also preferably germicidal reticulated or open cell hydrophilic and has a thickness of approximately $\frac{1}{16}$ to $\frac{1}{8}$ inch. All of the foam materials used in the present invention are assumed to be breathable and their thicknesses variable. Depending upon the application, some of the foam materials may not be used and the thickness of any foam material that is used can be changed as needed. For example, a foam called Aquazone by Foamex, Comfortemp by Frisby or Netsorb by Vita Olympic or the like can be used. Preferably, the germicidal antimicrobial hydrophilic or reticulated foam is attached to a nonwoven top sheet made of lycra, wood pulp and cotton, polypropylene, polyester, or rayon or a

combination thereof. Otherwise, this two part structure can be replaced with an elastomeric composite having a foam with a nonwoven top sheet formed in a single process. Preferably, in either case, the nonwoven top sheet is one manufactured by Dupont (Sontara Technology nonwoven), Dexter Synthetics, Veritex, Nordlys or the like.

The inner liner fabric is a moisture transfer fabric capable of wicking moisture. The inner liner 10 is preferably constructed using specific fabrics possessing certain desired characteristics, but with varying fiber compositions. A list of fabrics which can be employed depending upon the individual needs of their application as well as the individual needs of each skater are provided below. These fabrics may either be used individually or in combination. The following inner moisture transfer liner 10 materials may also be replaced by new moisture transfer fabrics with similar characteristics as the technology on the market develops for this invention.

The first fabric is an antimicrobial, antifungal polypropylene (also referred to as polyolefin) lycra blend (2%) with INNOVA fiber, or the like. INNOVA is a continuous filament fiber (manufactured by Deercreek Fabrics, Inc. or Menra Mills).

The second fabric is an antimicrobial, antifungal polypropylene having a polyester or cotton backing or the like (such as that manufactured by Coville, Inc.). This fabric has the face of one fiber and the backing of another and may vary

in composition depending on the performance level of the skater.

The third fabric is an antimicrobial, antifungal polypropylene/cotton blend with ALPHA fiber, or the like (such as that manufactured by Intex Fabric, Inc.).

The fourth fabric is a field sensor polyester with waffle weave construction (such as that distributed by Yagi & Co., Inc. and manufactured by Toray). This fabric is constructed to transfer moisture immediately away from the foot and performs best as the liner for the soft boot in-line skate. Alternatively, a polyester material known as Aqua-Dry, distributed by Teijin Shojin can be employed or the like.

The fifth fabric is a hydrophilic, antimicrobial Dri-lex Baby Kid or perforated material (such as that manufactured by Faytex Corp.).

The sixth fabric is a polyester looped Terry (such as that manufactured by Kronfli Spundale Mills, Inc.).

The seventh fabric is a sueded/sanded polyester microfiber material (such as that distributed by Yagi & Co., Inc. and Teijin Shojin, Inc., Miliken or Malden Mills).

The eighth fabric is an antimicrobial, antifungal Polar Tec Series 2000, which is a wickable, moisture transfer fiber, containing lycra, polypropylene, or the like.

Finally, the ninth fabric is Shoeller Dryskin 61487, or the like.

All of these fabrics have good moisture transfer characteristics which prevent damage to a skater's foot by

selecting the proper materials. Material 50 is positioned so as to allow the moisture to pass through into subsequent elements, such as waterproof/breathable membrane 60 and the outer shell 70, or an encapsulated outer fabric of the overall lining system. The outer fabric may also be treated with a waterproof film and may or may not be encapsulated. The third foam material 50 can be designed to provide a well defined heel lift, and heel pocket. The pocket may also contain a silicon gel or the like. This invention enables improved performance with the increased support around the heel, toe and ankle. The toe box is from top to bottom, wider and more flexible than in previous liners, specifically those described in U.S. Patent Nos. 5,092,614 and 5,397,141. The laminated foams under the heel support the skaters lower back and allows for a comfortable stride. With this added comfort, the aggressive or recreational skater can achieve a higher level of continued performance.

As shown in Figure 3, between the supporting second foam material 30 and the third foam material 50 is a structural mesh 40 which can be a flex guard, for example such as one manufactured by NALTEX or Conwed Plastics, or the like, that adds structural integrity to the lining system. A moldable foam, spacer material or silicon gel or the like may also be used in place of this flex guard or an air bladder. The moldable foam may or may not be a slow recovery foam by Rogers or the like. If it is not very breathable, it can be made breathable by puncturing. Alternatively, the moldable foam is

Abrasive protective material 110 is supplied by Schoeller or Dupont, for example.

The outer layer of fabric 70 of the lining system has 200 to 6000 denier strength and is made waterproof by a membrane, encapsulation technology or a waterproof film. If the waterproof film is applied to the outer fabric, then the membrane or encapsulation technology may be omitted.

Encapsulation technology is being utilized by company called Nectex, Inc. or Toray, Inc. (a Japanese company or the like). The breathable membranes preserve the outer layer of fabric 70 and perform as a waterproof barrier for the liners. If the encapsulation technology is applied to the outer layer of fabric 70, then the breathable laminate membranes need not be used. The encapsulation technology regulates the degree of waterproofness and breathability of the outer fabric shell by encapsulating an internal layer of fibers within the outer fabric. If the encapsulated fiber layer is closest to the fabric surface, the fabric is very waterproof and less breathable. If the layer is in the middle of the outer shell fabric, then the fabric is equally waterproofed and breathable.

The outer layer of fabric 70 is a combination of extremely durable, lightweight materials, kevlar/keprotec products 13207, 13624, 13632, 6500, 14705, 65563, 13602, 13408 (manufactured by Schoeller, Inc.), the Schoeller spirit line 14138, 14118, 14140, 14120, 14124, 14126, 14128, 14134, 14642, 14643, 14641, 14645, 14636, 14637, 14122, 14132, 14640, nylon

applied to any of the inner lining materials 20 to enhance the moisture transfer away from the foot. The antimicrobial antifungal polypropylene (polyolefin) fabrics quickly remove moisture away from the foot. Skin damage is minimized because the polypropylene fabric has a smooth, continuous surface. This fabric also prevents bacterial build-up which can cause foot odor and fungus.

The looped polyester terry blend or the like is an excellent wicking fabric and can remove moisture rapidly. A wetting agent by Witco, or the like, may be applied to enhance wickability.

The antimicrobial, antifungal Dri-lex nylon fabrics, like the polypropylene, is sanded and soft. The material not only removes moisture from the foot, but also is extremely comfortable and cool to the touch.

The polyester field sensor fabric or the like works well with those individuals who prefer sports or recreational skating. This liner absorbs moisture immediately and is recommended for the soft boot inner liner.

Finally, polyester microfiber fabric is advantageous in that it is cool to the touch, smooth and wickable. A wetting agent treatment enhances wickability.

As a result of using this lining system, the skater continues to have a cooler, drier foot. The lightweight kevlar, starlite and cordura, or the like, outer liner materials are twice as durable as the former heavyweight nylons often used on the outer shell, but function as a softer

feeling breathable outer surface and aid in the moisture transfer.

Figures 5(a) and 5(b) illustrate a sole portion 200 of a foot foam pad covered with cambrelle Dri-lex nylon, or the like. Preferably, however, the foot pad is designed using Sontara Technology nonwoven, by Dupont, and called ComforMaxSPORT. ComforMaxSPORT, or the like, is backed by hydrophilic moldable foam and helps protect foot bed from rubbing due to friction. The inserted hydrophilic antimicrobial foam (an open cell moisture vapor transfer foam) or slow recovery punctured foam foot pad adds support and transfers moisture downward. The bottom portion of the foam is preferably provided with a nonwoven top sheet as described earlier, a material called Saran@Climate Insoles by Fugafil or Summuntex 1, 2 by Textel may also be used in place of the foam foot bedfoot. The heel pocket foam or gel protects the back of the heel with a double layered reticulated and/or slow recovery moldable foam. This cushion protector allows circulation in the heel. ComforMaxSPORT or an antimicrobial cambrelle Dri-lex nylon 210, or the like, covers a molded hydrophilic foam 220 that supports the arch and insures the skater a comfortable stride.

Figures 6, 7 and 8 illustrate the tongue 300 of the boot in more detail. The tongue is designed to add further comfort and support. As shown in Figure 8, an inner liner fabric 310 of the tongue 300 is preferably one of the other inner liner materials mentioned above, especially the polypropylene lycra

blend with INNOVA fiber, the polyester microfiber or the polyester looped terry or the like. This inner liner fabric 310 is preferably laminated to a structural support foam 320, which is preferably a $\frac{1}{4}$ inch antimicrobial reticulated and/or slow recovery punctured foams. A hydrophilic open cell or reticulated perforated foam 330 abuts a structural support foam 320. The hydrophilic open cell or the slow recovery perforated foams 330 can take the shape of the foot bones and protect the upper foot from damage. A moldable spacer material may also be used in combination with foam 330 or in some cases in place of the foam 330. The structural support 320 can also be shaped to accommodate the foot and protect the ankle bones. A moisture transfer material 340 lies over the outer edges of the hydrophilic perforated foam or combination foam and spacer material 330 and is connected to the inner liner 310 and underlies the outer protective polyurethane layer 350. This moisture transfer material 340 is preferably made from a material known as aero-spacer Dri-lex, which is manufactured by Faytex Corp, or an aero-spacer fabric manufactured by Apex Mills or the like. Optionally, a nonwoven material such as Sontara Technology manufactured by Dupont can be used.

The nonwoven material, Sontara Technology, is a spun lace moisture management product called Typar, for example. It can have a sanded surface treatment or it can look like steel wool and would wrap around the top of the tongue. It should be understood that these nonwoven materials can always

stitching 370 and the inner liner fabric 310. It is recommended that lycra and nylon thread such as those used by the Dupont Xymid Group or Tietex be used for these stitched areas or adhesive bonding by Applied Extrusion Technologies, or the like. In fact, adhesive bonding may be utilized in place of or in combination with several stitched areas on the outer liner fabrics.

In-line skate tongues have in the past been hard vinyl edged forms. The shape of these tongues often did not fit the skater's foot. Furthermore, vinyls may damage the upper foot where they meet the inner lining edge during active use of the in-line skate. As a result, the skater may develop blisters, calluses or bruises on this upper foot area. Additionally, the inner fabrics of the tongue liner have often been non-breathable nylon or vinyl, thereby increasing the possibility of foot bacteria fungus to develop.

The liners are preferably provided with a pull tab 90 as illustrated in Figures 4, 9 and 10 on the back of a cuff 80 constructed of neoprene or reticulated foam covered by lycra, or the like. Figure 9 shows an opened up version of the liner looking from the back of the shoe. The outer upper cuff, that is exposed above the shell of the in-line skate removable liner, is provided to protect a skater's leg from abrasion. Located just beneath the cuff 80 is a abrasive grip fabric material 410, such as that manufactured by Schoeller, Inc. and referred to by the number 6500, or the like. Below material 410 is a reflective grip material 420. Below the reflective

grip material 420 is a highly abrasive fabric 110, as shown in Figure 4. The reflective material 14209 by Schoellar may also be used as fabric 110. Fabric 110 is preferable a Kevlar by Toray-Dupont or Schoeller (Keptotec or Schoeller spirit) or the like, Starlite, cordura, or the like. Finally, outer shell fabric 70 is the same as that shown in Figure 4, and can be any of the fabrics listed previously in connection with outer shell fabric 70. The nylon pull tab 90 allows the skater to easily slip into the liner.

Figure 10 shows the other side of the liner of Figure 9. In Figure 10, 510 can be a 1/4 inch punctured moldable foam, spacer fabric or an air bladder of a similar shape. The foam and air bladder may also be used in combination. Alternatively, the moldable foam can be substituted by a reticulated or hydrophilic, open-cell foam or silicon gel or the like. A nonwoven top-sheet (with or without apertures) can be attached to the moldable foam. Also, a spacer material, such as that made by Müller or the like, can be used as material 510. 520 represents the combination of the flexible mesh (in the case the moldable foam is not used, as depicted), the breathable membrane and the outer shell fabric, or encapsulated outer shell fabric. As in all of the Figures, the arrows depict the flow of moisture.

Figure 11 illustrates the toe portion 400 of the shoe. Preferably, the toe portion 400 is constructed with an inner liner 10, followed by a foam material 30, followed by a breathable membrane 60 and finally followed by the outer

comfort yet still maintain performance levels. This new technology in the in-line skate industry has increased tremendously the possibilities of a lighter weight performance product. However, the soft boot in-line skate does not have any type of lining system that even remotely resembles the lining system of the present invention. The liner of the soft boot can be adapted to this new moisture transfer system.

While the soft boot does not have a protective shell, nor a removable liner, it can nonetheless be provided with a liner that enjoys all of the benefits of the liner according to the present invention. Preferably, the outer layer of the moisture transfer system for the soft boot application would be a starlite Dri-lex nylon, Kevlar, or high abrasion cordura fabric, such as that manufactured by Schoeller, or the like. These fabrics, as well as the high abrasive fabrics, are encapsulated or are provided with a waterproof/breathable membrane laminated to their back or are encapsulated. A reticulated and/or open cell hydrophilic antimicrobial germicidal $\frac{1}{4}$ " foam abuts the encapsulated outer fabric or breathable membrane. The structural mesh or molded spacer material is stitch bonded or laminated to the $\frac{1}{4}$ reticulated or open cell hydrophilic foam. A slow recovery punctured foam or silicon gel, or the like, are located in the heel pocket is located both in the heel pocket, toe and tongue areas. An air bladder may also be added around the ankle areas to increase performance in some cases. The structural mesh or molded spacer materials abut a nonwoven top sheet that is laminated,

stitch or ultra sonically bonded to a reticulated and/or open cell hydrophilic $\frac{1}{4}$ " foam. The $\frac{1}{4}$ " foam abuts preferably a cellular elastomeric composite which is laminated to the inner fabric. A nonwoven top sheet laminated to $\frac{1}{8}$ " foam may also be used in place of the elastomeric composite. Also, instead of being removable, the liner would preferably be directly attached to the base of the soft boot by methods well known in the art, such as that disclosed in U.S. Patent No. 5,437,466. Substitutions can be made to all of the foam materials (ie. hydrophilic open cell, Aquazone, etc.) just as discussed earlier, and are not specifically repeated here. Other aspects of the present invention can be applied to the soft boot without any significant structural changes. The soft boot density is increased in the footbed, toe box, and heel plate. This added support provides, protection and assist in maintaining technical performance levels. The in-line soft boot breathability would be greatly enhanced with this added moisture transfer liner system. The soft boot may also employ the nonwoven top sheets in a number of combinations with the foam layers to increase moisture transfer.

Also, the soft boot outer shell may be a combination of synthetic breathable leather (such as that available from Daewoo, Inc. or the like), an encapsulated, waterproof film or breathable membrane outer fabric by Dupont, Schoeller, Burlington, Malden Performance Fabrics or any of the former fabrics mentioned, or the like, as well as synthetic rubbers, PVC, TPR or TPU, a thermoplastic composite material. Typar

